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REPORT OF THE FOURTH AFRICAN HIGHWAY MAINTENANCE CONFERENCE

Harare, Zimbabwe, 7-11 December 1987

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A. ORGANIZATION

1. The Fourth African Highway Maintenance Conference organized by the Economic Commission for Africa in collaboration with the Government of Zimbabwe was held in Harare, Zimbabwe from 7 to 11 December 1987.

2. The Government of the Republic of Zimbabwe organized a field trip on 10 December 1987 to the Central Material Laboratory and Training Centre, the Mount Hampden Maintenance Unit, the Heroe's Acre, the Mazowe Sattelite Earth Station and to an Irrigation Scheme.

B. ATTENDANCE AND PARTICIPATIONS

3. The Conference was attended by the following member States: Congo, Egypt, Ethiopia (People's Democratic Republic of), Ghana, Kenya, Malawi, Mali, Nigeria, Senegal and Zimbabwe.

4. The Conference was also attended by representatives of other United Nations member countries and organizations, namely: France, India, Norway, Poland, Sweden, Switzerland, United Kingdom and United States of America; United Nations Development Programme (UNDP) International Labour Organization (ILO), World Food Programme (WFP), World Bank, Organization for Economic Co-operation and Development (OECD), Eastern and Southern African Management Institute (ESAMI), Permanent International Association of Road Congress (PIARC), Preferential Trade Area (PTA), Swedish International Development Agency (SIDA), International road Federation (IRF), Swiss Development Corporation (SDC), Swedish National Road Administration (SNRA), Centre de Recherches Routiers (CRR-Belgium), NORAD, and SWEROAD.

C. ELECTION OF OFFICERS

5. The following officers were elected to make up the bureau of the Conference:

1. Chairman: Mr. Rabseck Mukumba (Zimbabwe)
2. First Vice Chairman: Mr. Stephen Bonsu (Ghana)
3. Second Vice Chairman: Mr. Hamdi El Wakkad (Egypt)
4. Third Vice Chairman: Mr. Ekouolo Jean Marie (Congo)
5. Rapporteur: Mr. Erick H. Msolomba (Malawi)

D. ADOPTION OF THE AGENDA

6. The Conference adopted the following agenda for the deliberations:

1. Opening of the meeting

(i) Welcome Address: Representative of the Host Government

(ii) Opening Statement: Representative of the United Nations Under-Secretary General and Executive Secretary of Economic Commission for Africa

(iii) Addresses by representatives of: (a) World Bank
(b) P.A.R.C.
(c) I.R.F.
(d) O.E.C.D.
(e) I.L.O.

(iv) Address by the heads of delegations: (a) Egypt
(b) Ethiopia

2. Road Maintenance Issues:

(i) The Road Maintenance Challenge in Africa: ECA Key Note Address

(ii) The UN Workshop on Road Maintenance in Developing Countries, in May 1987 in Stockholm, Sweden

(iii) Status of Road Maintenance in Zimbabwe

3. The Financial Aspect of Road Maintenance

(i) Road Deterioration in Africa: Financial Requirements and Cost Effective Technical Options (World Bank)

(ii) A perspective on Road Maintenance and Deterioration (TRRL)

(iii) Simplified Road Maintenance Systems: Financial Approach (France)

(iv) Discussion

4. Organization and Management of Resources

(i) Institutional Development and Training (World Bank)

(ii) Audio Visual Methodology in Road Maintenance Training: IRF Tapes

(iii) Audio Visual Methodology: Actual Experience in Malawi

(iv) Maintenance Technology (S.N.R.A.)

(v) Pavement Management of Primary and Secondary Roads in Belgium

(vi) Discussion: Institutional Issues

5. Maintenance Equipment, Labour, Contracts

(i) ILO Experience in Road Maintenance

(ii) WFP's Labour Intensive Food-for-Work Programme

(iii) Training Methods for Road Maintenance Personnel, Experience in Ethiopia

(iv) Roughness Progression Predictions Model in Tropical Africa (France) (paper distributed)

(v) Pavement Strengthening Methodology in Tropical Africa (CEBTP) (paper distributed)

(vi) Road Rehabilitation and Maintenance Projects of Swiss Development Co-operation in East Africa and Madagascar: Experiences and Lessons

(vii) The Maintenance Management System of Zimbabwe

(viii) Maintenance Aspect of Road Planning for SFRDP/Zimbabwe

(ix) Maintenance by Contract: The Ghana Experience

(x) In-situ Pavement Retreading Equipment for Developing Countries (France)

(xi) Discussion of Agenda Item 5, OPERATIONS

6. Workshop I: The ECA Road Maintenance Handbook

(i) Presentation (TRRL)

(ii) Experiences with the Handbook (Zimbabwe)

(iii) Discussion of Agenda Item 6, WORKSHOP I

7. Workshop II: Road Research and Applications to Maintenance (OECD)

(i) Pavement Management System

(ii) Maintenance of Unpaved Roads

(iii) Pavement Monitoring

(iv) Technology Transfer Mechanisms

(v) Discussion of Agenda 7, WORKSHOP ON MAINTENANCE RESEARCH

Field visits

8. Road Deterioration in Africa and Follow-up Under the SSATP Road Maintenance initiative: PANEL DISCUSSION

   (a) State of the African Road Network

   (b) Technical Options and Economic Consequences

   (c) The Institutional Challenge

   (d) Financial Requirements

   (e) Cost-Effective Maintenance Options

9. Other Matters

10. Conclusions and Recommendations

11. Date and Place of Fifth African Highway Maintenance Conference

12. Adoption of the Report

13. Closure of the Conference

E. ACCOUNT OF PROCEEDINGS

Opening of the Conference

7. The Conference was officially opened by the Acting Minister of Transport of Zimbabwe who welcomed the participants on behalf of the Government. He said that proper road maintenance is perhaps the most urgent transport issue facing countries today. He reminded participants that rapidly deteriorating road conditions constitute a serious deficiency in the transport system as a whole.

8. With regards to the causes of poor road maintenance, he singled out lack of foreign exchange for equipment and parts as the root cause of poor road maintenance.

9. He highlighted the three main themes of the Conference and stressed that there was absolutely no point in building new roads if countries cannot maintain the existing ones. With regard to the workshops' second theme on organization and management, he appealed to the conference participants to make specific recommendations on the subject of staff training for the road maintenance sector and also remunerative incentives for maintenance engineers and technical staff. The third theme, he said, dealt with maintenance equipment, labour, and contracts; and he appealed to the conference to address itself to all these issues with clear recommendations on how to solve the problems involved.

10. He concluded by calling upon the conference to also look into issues concerning safety for road users.

11. The representative of ECA secretariat read the speech of the ECA Executive Secretary to the conference. In his welcome address he thanked the Government and the people of Zimbabwe for hosting the Conference and for the hospitality extended to all delegates from their arrival in Harare. He expressed his gratitude to representatives of European Economic Community countries and participating international organizations for their assistance in making the conference a success.

12. He reminded the meeting of the three Pan African conferences held in the past and the recommendations agreed upon at the three meetings. He outlined the issues to be discussed under each agenda item and urged the participants to critically examine all aspects of the complex problem of highway maintenance in Africa, and come up with recommendations and suggestions that would be submitted to the Conference of African Ministers of Transport, Communications and Planning in March 1988 for their consideration and appropriate action.

13. In conclusion he said that the only option for the officials, professionals and members of the international community gathered at the conference was to intensify concerted efforts towards the formulation and implementation of appropriate and concerted action programmes aimed at improving the maintenance of the highway system.

14. A representative of the World Bank said in his opening address that although many African countries had pursued comprehensive maintenance and rehabilitation programmes, the results were still below expectations. He said that the capacity of African countries to face the requirements of good road maintenance has been undermined by the region's economic crisis. He underscored the importance of road transport, if African countries are to develop, and the consciousness created by previous conferences and seminars is to endure.

15. He informed the Conference that the Bank had pursued policy work in two directions. The first direction, he said, was the preparation of the policy paper on road deterioration in developing countries. The second was the development of the sub-Sahara transport programme which addressed the substance of the transport policy in Africa and also deviced the means by which African institutions might be further strengthened to deal with transport policy.

16. He concluded by saying that the present crisis called upon participants not only to do more, but better. He finally thanked ECA for the invitation extended to him to participate in the Conference.

17. A representative of the Permanent International Association of Road Congresses (PIARC) addressed the meeting and expressed his pleasure in participating in the Conference. He informed the meeting that PIARC grouped together 60 governments and had a membership of 74 countries, of which 17 were in Africa. Regarding its composition he said that PIARC had 12 technical committees comprising 400 members from 35 countries. He briefed the meeting of the PIARC world conference which was held recently in Brussels with the participation of 23 African countries.

18. He outlined the outcome of the conference and said that PIARC was at the disposal of National Highway Departments, and as a non-profit organization PIARC was mainly interested in promoting general progress in the roads sub-sector.

19. He informed the meeting that the next PIARC World Highway Conference would take place in Africa in 1991, and concluded by inviting participants to attend the meeting which would be held in Marrakech.

20. A representative of the International Road Federation (IRF) in his opening remarks thanked the Zimbabwe Government and ECA for the opportunity given to him to participate in the Conference. He informed the meeting that IRF was founded in 1948 as a non-profit, and non-political organization with the objective of assisting in the development of roads. He informed the meeting that his organization had a membership of over 500 Governments, companies and associations around the world. He disclosed that the Peoples Republic of China had joined the organization recently.

21. With regard to activities of IRF he said that the organization was active in arranging world and regional meetings, executive conferences, seminars and symposiums, fellowship programmes, professional study programmes, publications, and videotape programmes for training. The next VIIth IRF African Highway Conference would be held in Dakar, Senegal, in 1990, he said.

22. A representative of the Organization for Economic Co-operation and Development (OECD) expressed his appreciation to the Zimbabwe Government and ECA for organizing the Conference. He said that the road maintenance challenge in sub-Sahara Africa needed sustained efforts. He further said that there was need for institutional building, political commitment and cost-effective management procedures if long-term strategies for road maintenance were to be met.

23. He concluded by saying that although road maintenance was priority number one for OECD, R-T-R committee was also considering research on traffic safety policies.

24. The representative of the International Labour Organization (ILO) said in his opening address that ILO investment in the roads sector dated back to 1970, and had been concerned mainly with the rational utilization of resources with an emphasis on the development of labour-intensive techniques for road construction, rehabilitation and maintenance. He informed the meeting that documentation which ILO had published since 1974 covered a wide range of topics including supervisory training, tools and equipment, and training materials for construction and maintenance engineers. He concluded by informing the meeting that ILO's contributions to the Conference would be based on past experience.

25. The delegate of the Arab Republic of Egypt, in his opening address thanked ECA and the Republic of Zimbabwe for the invitation to participate in the Conference. He informed the meeting that building the road network in Egypt had been carried out in three stages. The first stage which took place up-to 1947, had 14,000 km of roads of which only 1,951 kms were paved. The second stage covered the period 1947 to 1952 and witnessed some improvement. The total length of roads was about 17,000 kms, of which 1,727 kms were paved by 1957. The third stage, he said, was from 1952 to 1987 when 15,000 kms of roads were paved out of a total length of 35,000 kms.

26. He outlined the three groups of road classifications in Egypt, and briefed the meeting on the geographical and historical position of Egypt and its relation to transport between Africa, Asia, Europe and other parts of the world. He concluded by saying that the most important duty facing Egypt currently was how to maintain the existing road network.

27. The leader of the delegation of the Peoples Democratic Republic of Ethiopia opened his statement by thanking the people of Zimbabwe for their warm welcome. He informed the meeting that although road was the most important mode of transport in Ethiopia, the existing network of 5,000 km of paved roads and 12,000 of gravel roads was inadequate. He outlined factors which contributed to the deficiencies in road maintenance standards, and informed the meeting that Ethiopia was introducing management systems related to road maintenance, which depended on availability of qualified staff.

28. He informed the Conference that Ethiopia experienced lack of maintenance equipment and the situation was likely to remain unchanged for some time. With regard to the age of the road network, he said that nearly one third of the network was built before 1940 when the legal axle load was about 8 tons. He said that a proposal for the modification of the existing legislation to a general axle load of 10 tons, with provision for 12 tons, was currently under consideration.

29. He outlined the steps necessary for increased awareness of road maintenance and concluded by saying that without reliable road transportation in the region, Africa was bound to suffer in the process of its economic development.

Road Maintenance Issues (agenda item 2)

(i) The Road Maintenance Challenge in Africa

30. The representative of the ECA secretariat, in presenting document TRANS/AHMC/87/4/2, said that African countries during the last two decades had built up, restructured, and modernized their highway networks at great expenses and sacrifices, but had not been successful in properly maintaining their road investments. Meanwhile traffic had increased considerably resulting in the over-use and abuse of the national networks. Poor maintenance reflected heavily on vehicle operating costs, in the form of added expenditure in foreign exchange for importation of spare parts and supplies; and consequently, for increases in trucking costs which were in turn passed on to the consumer.

31. Maintenance was unglamorous professionally and unspectacular politically, and was a convenient area for budget cuts.

32. There are a few basic issues to contend with, including inadequate funding, inefficient utilization of resources, unawareness of the importance of road maintenance, lack of expertise in maintenance management and lack of incentives for maintenance staff.

33. The ECA had previously organized three regional maintenance conferences (1974, 1977, 1982) and two subregional maintenance seminars (1982, 1985), where participating governments had been unanimous in their call for improved maintenance performance on a pricrity basis. A major outcome of the conferences was the production and free distribution of the ECA road maintenance Handbook, which was in great demand throughout the region.

34. Inspite of gallant efforts made by African Governments, and despite the technical, financial and moral support provided by the international community (the UN System included), road networks in Africa were still poorly maintained and were decaying; and the cost of rehabilitating the infrastructure was approaching astronomical proportions.

35. The new ECA/World Bank initiative to organize a series of awareness building workshops therefore deserved the utmost attention and support of African governments. If successful, they should lead to concrete action programmes aimed at improving maintenance performance in several African countries within a short period of time.

36. There was a road maintenance challenge in Africa, it was concluded, and Africa needed to face that challenge with resolve.

37. Recommendations contained in the ECA paper included consideration of contract-maintenance; the establishment of autonomous equipment pools, productivity performance bonuses, road funds and revolving funds; and the introduction of the lengthman concept and labour intensive methods in maintenance operations.

(ii) The UN Workshop on Road Maintenance

38. In introducing the document on the UN Workshop on Road Maintenance, a representative of Sweroad said that the Workshop on Road Maintenance was held in Stockholm on 11-17 May 1987. It was organized by the United Nations Department of Technical Co-operation for Development (DTCD) in collaboration with the Government of Sweden. He explained that the arrangements for the Workshop were made by the Swedish Road Maintenance Group, and that the participants for the Workshop came from more than 20 different countries around the world.

39. He said that conclusions and recommendations of the Workshops were the following:

- The successful organization of road maintenance activities can play an important role in improving the utilization of the road system and facilitating the movement of people and commodities. That, however, required competent planning, designing, financing and scheduling, in addition to training human resources.

- The participants expressed special concern regarding the state of maintenance of the existing road system in the developing world, lack of funds allocated for the purpose and in, many cases, absence of separate maintenance organizations. It was felt that adequate maintenance should be one of the foremost considerations of the planning process and had first claim on the resources available.

- The current trend in developing countries was to add more mileage to the existing road system without giving due priority to the needs of maintenance. It was a common phenomenon to let the existing system deteriorate and go almost out of commission.

- Great interest was expressed at the Workshop in the modern methods and techniques of road maintenance, maintenance management systems and road maintenance equipment. It was felt that lack of finances, particularly foreign exchange and availability of local labour may limit the change-over to mechanical methods of road maintenance, but certain operations would need the use of equipment. Perhaps a happy combination of machine and manual methods could be evolved, keeping in mind the needs and resources of individual countries.

- Considerable interest was expressed in the use of maintenance management systems available and in use in various countries. They were considered a useful tool in the hand of the administrators, planners and field staff to determine requirements of funds, priorities and implementation programmes. A pre-requisite to the evolution of a maintenance management system was the establishment of a data base, which was almost non-existent in many developing countries. The need, therefore, for the management of the data base to prioritize the maintenance needs was keenly felt so as to lead to the next stage of adoption of a maintenance planning system. That required computer hardware and software as well as expert advisory services and adequately trained local personnel.

- The participants greatly stressed the need for such professional gatherings in the form of workshops, seminars and training courses for representatives from developing countries, under the auspices of the United Nations. Such forums provided an excellent opportunity for exposure to new developments, exchange of ideas and to see new tools and equipment in use.

(iii) Status of Road Maintenance in Zimbabwe

40. A delegate from Zimbabwe presented a status report on road maintenance in Zimbabwe. He said that objectives of road maintenance in his country were to preserve the capital investment, to reduce vehicle operating costs, and maximize the safety of road users. He informed the meeting that the four authorities involved in the maintenance of the network in Zimbabwe were the State, rural councils, municipalities and district councils. He outlined the road network and existing conditions on state roads including the traffic. He informed the meeting that recurrent expenditure on maintenance is divided among routine, periodic and enhanced maintenance activities. With regards to the state maintenance organization, he informed the meeting that the maintenance branch in head office is responsible for the overall organization of maintenance.

41. He concluded by informing the meeting that apart from problems of funding, common maintenance problems include lack of spare parts and erratic supply of bitumen and other maintenance materials.

The Financial Aspect of Road Maintenance (agenda item 3)

(i) Road Deterioration in Africa: Financial Requirements and Cost Effective Technical Options (World Bank)

42. In the presentation of this agenda item, Mr. Fossberg of the World Bank said that a recent survey done by the World Bank, covering 85 developing countries (39 of them in Africa), showed that the road condition in the developing world was in a precarious state, with a large proportion of roads being in a poor condition (for Africa, some 25 per cent of the paved networks and some of the unpaved roads), and a similar proportion being in a state that would soon lead them into the 'poor' category. The estimated cost worldwide for restoring the road networks was some US$40 billion, of which some US$5 billion would be for Africa alone. That amount would double over the next 10 years as more roads deteriorated. To respond to that situation proper planning and prioritization of the use of scarce resources was absolutely essential.

43. The response should be along three lines:

(a) Technical-economic)

(b) Financial) dealt with in the current Session

(c) Institutional (which would be dealt with in agenda 4)

(a) Technical-economic

44. The tools for technical and economic analysis had been considerably sharpened during the last decade or two due to two important factors:

(i) better prediction models, both for pavement performance and for vehicle operating costs; and

(ii) computerized analysis, permitting evaluation of a vast array of options.

45. That had heralded a new era in rational highway planning and management; and analyses could be carried out, both at the road network level, to decide on priorites and maintenance intervention thresholds, and at the executive level where, by monitoring, one could decide when given thresholds of pavement distress had been reached. The first type of analysis had been used in a wide-ranging series of policy investigations carried out by the World Bank.

46. The analyses showed that bituminous paving of a road could be feasible in the range 100-400 vehicles per day AADT, depending on factors like climate and materials, relative costs of construction and maintenance elements, and expected traffic growth and discount rate. The analyses of pavement design strength indicated engineering principles, and while stage construction could be an appropriate solution when subsequent maintenance and rehabilitation is secured, such solutions could be disastrous when appropriate follow-up was not forthcoming.

47. Total life-cycle analysis permits the selection of the optimum construction-maintenance-rehabilitation strategy for each of the roads, or sets of similar roads, in the network, so as to minimize total transport costs. For constrained budgets, methodologies are available that permit cutting back highway agency expenditures on such activities where the total economic loss is the least, so as still to maximize economic benefits within the budget available. While maintaining high-traffic pavements in a good condition is a high priority, roads with very low traffic would warrant at least regular patching, rather than abandonment.

48. To meet the road restoration needs, Africa would need to spend some US$1.2 billion annually if spread over 10 years, or some US$1.7 billion annually if spread over 5 years. In percentage of GNP terms, it was far above that required in other parts of the world. It reflected the costliness of roads in Africa, in terms of low road km/km^2, low road km/population, and high road km/unit GNP.

49. However there was a wide divergence between countries both with regard to the seriousness of the problem, and the capacity to restore the network. While a few African countries could get by with moderate to substantial increase (say 50 per cent) in the road budgets, provided new construction works are curtailed, a very large proportion of the countries could not get by that way, and could depend on transfer of external resources to achieve a long-term and

sustainable improvement. Critical for all categories was the curtailment of new construction, and the reallocation of resources from construction to maintenance. Also required would be substantial improvement in institutional performance.

50. The marshalling of resources to meet those needs could be done along the lines illustrated below:

(i) Taxation: This is a common and convenient source of revenue, but care must be taken that increased taxation does not distort transport costs. Thus, the taxes should be equitable, so that the vehicles pay for the damage they do to the roads, and should be so structured as to encourage vehicle and axle configurations that will reduce road damage.

(ii) Earmarking revenues, and/or creating a road fund: There are some principal objections to this on fiscal grounds, but has been found acceptable, and has been successful in some critical cases.

(iii) Toll roads: These are gaining increasing acceptance.

(iv) External financing: Such assistance should in the future be geared more to the attainment of institutional and managerial goal, and the pursuit of high-priority activities. The assistance would have to be based on close co-ordination between the donors and the recipient governemnt.

(ii) A Perspective on Road Maintenance in Africa, by the Representative of the UK/TRRL

51. Most African countries have placed considerable emphasis on building up their road networks during the post-colonial era as this has been seen as an essential component of a comprehensive development programme. However, during this period of rapid expansion of road networks, many African countries have neglected maintenance. The problem of maintaining the networks is now increasing as a direct consequence of this rapid expansion, plus the problems caused by increases in traffic volumes and the need to spread limited maintenance resources over an expanding network. The problem is exacerbated by the damage being done to roads by overloaded vehicles. It was recognized some time ago that only in relatively few countries was the maintenance effort sufficient to maintain the roads in anything approaching an optimum economic condition, and there were fears that this would result in a gradual decline in the serviceability of road networks.

52. Several reasons were identified for this lack of adequate maintenance, including insufficient funds, shortages of skilled and experienced staff, inadequate management, plus foreign exchange constraints on capital equipment and spares. In particular, difficulties were being caused by attitudes to maintenance at all levels. Politicians often sought prestige by constructing new works and planners often favoured capital projects because of the easily measurable developmental benefits. Furthermore, senior engineers in road departments often themselves preferred that emphasis should be on new construction rather than on maintenance.

53. It is essential that African countries provide adequate finance for maintenance and support this with an appropriate commitment of foreign exchange resources. The need for staff training should be emphasized, but any benefits will only be realized if trained staff are adequately reimbursed and provided with incentives to perform well. The use of private maintenance contractors has much to offer in this respect and countries should be encouraged to experiment with their use. For maintenance operation to increase in efficiency, there is a need to strengthen management at all levels. There is also considerable potential use for labour intensive methods that will have a much lower requirement for foreign exchange, but have much greater need for management skills. More use could perhaps be made of concrete roads since, with their potentially lower maintenance requirement, they will place fewer demands on the maintenance organization for many years into the future. Applied research should be carried out to seek ways of reducing maintenance needs and to develop the means of increasing ability to carry works out.

54. There is an increasing awareness of the road maintenance problem in African countries. What is needed now is a concerted effort by the countries themselves supported by co-ordinated and appropriate actions by bilateral and multilateral aid donors to build up institutions and to develop road maintenance capability.

(iii) Simplified Approach for the Management of Maintenance Budgets for Highway Systems, Presented by Mr. J.P. Morin of France

55. Highway maintenance budgeting over long periods of time (one or several three-year or five-year plans for example) calls for an estimate of all yearly expenditures of these periods. Apart from that, the maintenance strategy selected for the first budgetary period will have an effect on future yearly budgets.

56. For example, highways in very bad condition and not maintained when necessary, e.g. during the first period, will necessarily require maintenance works in the course of the following period. Consequently budgets corresponding to the different periods are interdependent and must always be borne in mind.

57. Another basic factor considered is that a highway, even if it is correctly maintained, will inevitably deteriorate with time and traffic, from a good state to a fair state and then to a poor state.

58. The passage from good to fair and fair to poor takes place in distinct steps, and can be measured either by an auscultation (monitoring) of the pavement (using equipment such as deflectograph, bump integrator) or by a visual inspection performed by any highway technician.

(iv) Discussion of Agenda Item 3: FINANCE

59. In the discussions which followed the presentations of the agenda item, it was revealed that although technical problems in road maintenance in Africa were generally well known, the financial approach to those problems should be improved in the following way:

- careful programming of financial requirements for road maintenance;
- participation in meetings on road maintenance, in order to effectively sensitize national and international sources of funding;
- improved presentation of funding requests in the sector, with particular emphasis on the cost/effectiveness aspect of road maintenance programmes;
- integration as far as possible of maintenance projects in all funding requests for the construction of new roads;

initiation of payment of tolls while ensuring that the proceeds from it adequately and effectively contributed to the road maintenance programme;

- establishment of national funds for road maintenance.

60. The meeting also felt that specific attention should be paid to questions concerning encouragement and training of road maintenance personnel, more effective distribution of responsibilities among organizations involved in road maintenance, the establishment of effective regulations in the sector, particularly with regard to restriction on axle load, the strengthening of controls at all levels, the use of simple and adapted methods for inspection of road conditions (visual inspection, roughness tests, etc.). With regard to the difficulty in ensuring effective control of the application of regulations particularly pertaining to overloading, it was necessary on one hand, to envisage road construction, rehabilitation and maintenance in relation to the actual loads they could support. On the other hand, it would be necessary to reinforce the monitoring mechanisms at the disposal of the various administrations, such as:

- strict monitoring of the importation of vehicles;

- levying of taxes in relation to axle load;

- the promotion of multiple axle vehicles;

- measures for checking weight through the use of fixed or mobile weighbridges.

Organization and Management of Resources (agenda item 4)

(i) Institutional Development and Training

61. The first speaker and moderator of this item 4, Mr. Doyen from the World Bank, pursued the presentation of the institutional aspects of the Road Deterioration and reviewed current issues and orientations of programmes supported by the Bank in the fields of institutional development, training and technical assistance.

62. He said that the Road Deterioration paper puts institutional capacity at the centre of the road deterioration crisis, noting that damage could have been contained by more effective, responsible and attentive institutions. Institution is the key element without which other measures will falter.

63. He pointed out that the key elements of needed institutional reforms are:

- Increased political attention to the preservation of roads;

- Strengthening of accountability both within road organizations and vis-a-vis users and the public at large;

- Introduction of incentives for performance.

64. He said further that strengthened accountability would have to be pursued by the following means:

- Work programming linking budgets with physical outputs;

- Separation of planning and evaluation from execution;

- Monitoring of road conditions.

65. Following the example of other continents, road councils regrouping representatives of government and of economic agents and transport operators, could play an important role in promoting road maintenance and developing accountability to users.

66. The Bank has a long record of supporting institutional development through a combination of organizational measures, training and technical assistance. Sustained progress has been difficult to achieve. The review of recent experience offers no standard recipe or model, but points out the need to recognize the long-term nature of institutional build-up and to take into account absorptive capacity in the design of each successive phase.

(a) As far as training is concerned the following elements are of particular importance:

- sustained interest and commitment of senior management;

- accurate diagnosis of needs and quality of design;

- integration with personnel management policy.

(b) Technical assistance is a highly visible component of Bank-financed operations representing more than fifteen per cent of Bank/IDA lending to sub-Saharan Africa. A recent review has recommended the following orientations:

- strengthening of co-ordination and management

- increased use of local capacity;

- innovative sourcing (twinning, NGO's) and contracting (linked with results);

- careful selection of counterparts.

67. Summarizing, he said that cases of successful institutional development show the following recurring features:

- Clear institutional mandate with related resource allocation mechanism and accountability;

- Incentive and personnel management system encouraging performance.

- Commitment to training and staff development.

68. He concluded by saying that the present conference had shown several examples of road organizations achieving sustained institutional progress, offering precious lessons for all.

(ii) Audio-visual Methodology in Road Maintenance Training

69. A representative of the IRF presented a paper on the topic and said that the IRF videotapes were designed to improve training process for road-related activities throughout the world. He informed the meeting that IRF research has indicated that:

1. The most immediate training needs were in the area of road maintenance;

2. There was a need for widely applicable training methods and generic training materials that could be used in most training programmes;

3. The IRF tapes should be directed to the supervisory personnel in the field;

4. Videotapes should be selected as the delivery medium.

70. Therefore, the initial development of the tapes is directed to road maintenance tasks and skills. He said also that the next subject area will be in maintenance management.

71. With regards to the IRF library, he said that the library was organized so that each videotape demonstrates the fundamental work steps of a specific job, task, or skill. He informed the meeting that 61 videotapes covered the maintenance tasks and skills and 5 videotapes would be on maintenance management systems (mms) making a total of 66 videotapes on Road Maintenance.

72. He further informed the meeting that the development of IRF videotapes started in 1983 with the research on training need and existing training materials; and with development of the videotapes concept, two pilot videotapes were produced and evaluated. He said that the first 24 videotapes on road maintenance tasks and equipment maintenance tasks were produced between 1985 and 1986. The meeting was informed that the above development costs were financed by the Ministry of Communications in Saudi Arabia. All 24 videotapes were available in English, Arabic and Spanish. The French version, he said, would be developed in the near future. He told the meeting that an international Advisory Council of 17 members including the UN, World Bank, and government highway agencies, and a local Review Board of 7 experts from the World Bank, USAID, FHWA assisted IRF in the reviewing of the curriculum and course outlines. He further said that by the end of November 1987, more than 1,500 tapes had been placed in 29 countries; and informed the meeting that with revenue collected, 9 new videotapes on equipment operation are being produced and would be available in late 1988, with the remaining 33 to be produced between 1988 and 1991.

73.. He concluded that the IRF videotapes which demonstrated the road maintenance tasks step by step in real life situations provided a cost-effective tool for training the road maintenance personnel.

74. A demonstration videotape which described the IRF videotape library and included excerpts from 9 representative videotapes of the road maintenance series was shown.

(iii) Audio Visual Methodology: Actual Experiences

75. A delegate from Malawi, in his introductory remarks, highlighted the training efforts the Roads Department in Malawi's Ministry of Works and Supplies (MOWS) was making to improve its road maintenance capabilities. He said that MOWS had the personnel and the technical knowhow to maintain roads, but funding for road maintenance was limited. To ensure that the funds allocated were used on most important activities of the roads network, a maintenance management system was established. He also said that training efforts by consultants and the ministry's headquarters engineers failed to cover all staff, therefore, it was decided to decentralize training. He said that training modules of work methods, as well as equipment maintenance were prepared for each maintenance activity. He informed the meeting that IRF videotapes were used to supplement their training, but for most work methods, the method shown on IRF tapes had been adapted in order to produce Malawi's own Road Maintenance Manual.

76. He concluded by saying that the training efforts in Malawi had been very fruitful and that it had been possible to reach all personnel in the roads department. He also said that the decentralized training was in relation to current maintenance activities; an approach which has resulted in reduced costs of training, and the imparting of training capabilities to various levels of personnel in the department.

(iv) Maintenance Technology

77. The document on Maintenance Technology was presented by a representative of the Swedish National Road Administration who said that 40 per cent of the State Roads in Northern Sweden were gravel roads, many of them with a traffic flow of less than 200 vehicles a day. He said that in general maintenance, the grader was a useful tool and that there seemed to be two main approaches to improve methods for maintenance of gravel road surfaces. One was improving the performance of the motor graders, and the other was using less sophisticated grading or dragging methods. He further said that the following attachments for maintenance grading are of interest: Gravel Windrow Eliminator, Quick Connection Equipment, and Special Outfit for Shoulder Grading. He explained that a good drainage was very important for a gravel road and concluded that an efficient tool was the grader mounted ditch-plow.

78. With regards to high quality gravel wearing course he said that there was need for high quality material and discussed the projection showing the ideal gravel wearing course. He explained that the particle size should not exceed 16 - 20 mm. and that once suitable wearing course material has been placed on the road, there were methods for maintaining a good surface quality by recycling material from the shoulders and the slopes of the road.

79. He said that they normally paved the road if the traffic was more than 250 vehicles per day and used Single Surface Treatment or Cold Mixed Oiled Gravel. He explained that recycling of oiled gravel was very easy to do. The method was used when reconstructing old oiled gravel roads he explained. He said that surface potholes required immediate attention in order to prevent pavement deterioration. He explained that they measured the brearing capacity using a mobile computerized falling weight deflectometer and that in measuring the deflections, the equipment calculated what thichkness of base layer was needed. He concluded that in that manner optimum use was made of base material.

(v) The Belgian Road Management System

80. A representative of the Belgian Road Research Centre informed the meeting that Belgium, a relatively small country of 30,000 km^2 in size, supported a population of about 9½ million which was served by a road network of approximately 120,000 kms, out of which 16,000 were state roads and motorways. He said that the national network under the supervision of the Belgian Road Administration was being progressively managed by a system composed of an automated road data acquisition system, a road data base, and a network optimization system.

81. He further said that attention was focused on parameters characterizing skid resistance, longitudinal profile, with bearing capacity and road deterioration which were being monitored by high grade measuring equipment. He informed the meeting that all data were logged into the road data base, which in turn would provide up to the minute information about the condition of roads throughout the country. He outlined key components of the network optimization system and said it included:

- prediction models for the inspection parameters;
- criteria which have been set for those parametres;
- analysis of the cost and effect of various road maintenance techniques on those parametres; and
- optimization routines.

82. He concluded his presentation by saying that the management principles adopted for secondary roads differed from those applied to state roads in the following aspects:

- a functional classification was required in order to determine design speed and expected traffic volume;
- a diagnosis was made to identify the causes of deterioration; and
- a safety criteria was adopted which may lead to improving the alignment.

(vi) Discussion of Agenda Item 3: INSTITUTIONS

83. In the discussions that followed, exchanges between the representatives of Senegal and Malawi brought out the fact that in Malawi, cost and usefulness considerations had been the main reasons for shifting away from centrally-run Training Production Units (TPU) toward reliance on direct on-the-job training by supervisors. In Senegal staff were initially not motivated to attend training activities because training did not result in upgrading of their condition. Eventually, the statutes of the training centre were revised and a series of seminars were organized to consider the problem. Motivations had been built-up especially among the younger staff.

84. Answering a question on the use of covenants to support institutional development programmes, Mr. Fossberg, from the World Bank, indicated that the recent tendency was to prepare action plans with long-term perspective.

85. The IRF representative clarified the fact that unpaved roads were the subject of several videotapes. The representative of ILO pointed out that videotapes on labour-intensive maintenance techniques were being developed by his organization.

86. The Director of PTA Transport Division stressed the particular relevance of work programming to avoid diversion towards non-maintenance tasks. He recommended that training of technicians and trainers should be the focus of subregional co-operation.

87. In summing up results of the discussions the Moderator pointed out that:

- Institutional development was emerging as the basis of all efforts to address road maintenance, and experience gained with longstanding institutional programmes were providing a better understanding of the key ingredients of success.

- The introduction of Maintenance Management Systems (MMS) should be part of a broader programme of institutional upgrading emphasising functional training and flexible implementation.

- Riding quality and resilience of unpaved roads could be increased considerably by the careful selection of materials used for surfacing.

- Videotapes were emerging as effective instruments for road maintenance training.

Equipment, Labour and Contracts (Agenda item 5)

88. This session on the operational aspect of road maintenance was moderated by Mr. P. Bentall of the International Labour Organization (ILO). The following are summaries of papers presented and later discussed in depth at the Conference.

(i) The Rational Utilization of Available Resources for Road Improvement and Maintenance; Alternative Approaches, by J. de Veen of the ILO

89. The paper stated that statistics had shown conclusively that in practically all African countries the condition of the road network is rapidly deteriorating, primarily due to a shortfall of timely and regular maintenance. Available human and material resources were inadequate, domestic financing was on the decrease in real terms. External financing was available mostly for construction rather than maintenance; and to exacerbate the situation, available resources were being used inefficiently, and maintenance activities were generally poorly planned, programmed and supervised.

90. Governments and donor agencies had become increasingly aware of the shortcomings of road maintenance systems and of the urgent need to change. The ILO Road Maintenance meeting in Gaborone and the ECA/World Bank road maintenance meetings of 1982, as well as donor meetings on the road maintenance problem in Paris in 1980 and London in 1985 discussed formulation of action guidelines and the necessary emergency measure required.

91. For a long time, the general approach to improve the situation has been to provide more equipment, to upgrade workshop facilities, to introduce administrative and informative systems, and to train staff in their use. Options open to road maintenance organizations included spreading resources thinly over the whole network, or selecting only that part of the network for which adequate resources are available, developing more cost-effective approaches, and increasing productivity. The ILO has developed a model to guide the road maintenance engineer in making assessments of the road maintenance situation at national level, that can be adapted to assess cost-effectiveness at regional district or divisional levels, which will have a major impact on decision-making as regards the choice of technology in road maintenance.

(ii) WFP's Involvement in Labour Intensive Road Maintenance Through Food-for-Work Schemes by P. Simkin, World Food Programme

92. Recurrent cost problems, currently faced by many developing countries, are most acute in the poorest of the developing countries. In the United Nations General Assembly Special Session on Africa, held in May 1986, inadequate operation and maintenance was emphasized as a key problem area. A range of possible policy options for the World Food Programme are being considered for a response to this serious problem, and they include increasing support for maintenance activities within projects, encouraging more community involvement and self-help, supporting the more economically viable projects and acting as a catalyst amongst other donors.

93. The most common understanding of the recurrent cost problem is simply the lack of funds to maintain, rehabilitate and reconstruct public works. One of the major manifestations of this problem include the deterioration of economic infrastructure, for example, roads, mule tracks, irrigation canals, etc.

94. Food aid can be used to support public works programmes in different ways. Commodities are provided for use as partial payment of wages to workers on public works and to assist self-help labour-intensive works organized at the community level. The remainder of the remunerations is provided in the form of food, usually valued at considerably more than 50 per cent of the wage.

95. The UNDP/ILO Special Public Works Programmes address recurrent costs (the operating budget) which includes use and maintenance of technical capital, and expenditure related to providing for workers to operate the technical capital. Of particular concern is attention to road infrastructures: cleaning ditches and run-offs, cleaning pipes, culverts and bridge approaches, making shoulders and banks, filling potholes and cracks (patching), filling and repacking damaged stretches, and minor structural repairs.

96. The World Food Programme's approach to assisting in this area has been, wherever possible, to provide food aid to support maintenance within projects. WFP experience in providing food for "maintenance/rehabilitation" work in Ethiopia, Rwanda, Burundi, Ghana, etc., has been positive and shown favorable results. Food for maintenance/rehabilitation work in whole or in part provides an incentive for labour mobilization (particularly in food deficit areas), enables labour to be attracted, reduces absenteeism, and raises productivity, either through the incentive effect or by providing a better diet to the worker.

97. The World Food Programme currently has 29 projects worth more than $208 million and a total food cost of $147.5 million which contain wholly or in part a component of road maintenance and/or rehabilitation.

98. In all WFP food-for-work projects, an attempt is made to ensure that after the works are completed there is adequate promise for their continued maintenance and cost of upkeep. For public works this is the responsibility of the governments concerned and they are asked to provide assurances that adequate budgetary funds will be forthcoming on a regular basis for this purpose. In self-help activities, the responsibility is clearly the country's and efforts are made to motivate them to accept the continuing responsibility for maintenance. Where this cannot be assured for justifiable reasons, WFP may provide food aid for a certain period to encourage and support maintenance activities and to stimulate the social organization necessary to assume the continuing responsibility. In the case of some public works, WFP is prepared to provide food aid for rehabilitation and maintenance rather than for new construction where there is clear evidence that this would be more cost-effective.

(iii) Training Methods for Road Maintenance Personnel, Experience in Ethiopia by Steve Griffith, IRF/Roy Jorgensen

99. The beginning of a modern highway organization in Ethiopia commenced with the establishment of the Ethiopian Highway Authority in 1950. Since then there have been three basic stages to the development of the highway organization and road network within Ethiopia.

Stage I	1950-1974	-	Trunk and primary road construction
Stage II	1974-1980	-	Main and rural roads
Stage III	1980-present	-	Main, rural and municipal roads, airfields, seaports and railroads

100. Much of the development of maintenance requirements and the associated training can be divided into these stages as well.

101. Today, the Ethiopian Transport Construction Authority (ETCA) is responsible for a broad range of construction and maintenance activities with a workforce of between 17,000 and 20,000 employees depending on seasonal employment and an all-weather road network of 13,306 km.

102. The Training and Testing Branch, which was established in 1956, is currently part of the Administrative Services and Training Division, and includes two highway construction and maintenance Training Production Units ((TPU), one for main highways and one for low volume rural roads. At present the training centre operated by the Branch can accommodate 120 trainees with full boarding and classroom facilities. Training activities conducted at the Centre include testing, classroom and practical instruction, orientation of new employees, and hands-on mechanical shop and equipment operator training.

103. From the beginning of the organized training effort in 1956 records have been kept on the number and type of personnel who have received some type of training. On the average 525 people per year have been trained in some formal manner during the 18 year period. This may seem like a formidable number, however, one must keep in mind the current staffing and then look at the requirements. Based on a current staffing level of 20,000 personnel, 525 employees trained per year amounts to only 2.6 per cent of the total work force. At this rate considering an employee turnover rate of 10 per cent or more, any training given, on the average, will lose its initial value after a 5 year period. Therefore, there is great need not only to revise and update the training technology but to expand the scope of the training to reach more employees, particularly in the maintenance area.

104. Currently, the re-emphasis on training in general has produced a new programme for training maintenance personnel. This programme will be implemented by the Training and Testing Branch and is divided into three segments.

105. Segment one involves training in maintenance management. This is focused at ETCA personnel who operate and use the maintenance management system. A new set of lesson plans and handouts along with an Intructors Guide will be provided to Trainers at the Alem Gena Training Centre. They are currently being taught how to use the system so they in turn can teach others.

106. Segment two involves training of selected maintenance operations personnel in the correct maintenance activity work steps. This training will first focus on selected Labour Foreman and Section Foreman who need to be taught or retaught the basic fundamentals of proper maintenance using mechanized or semi-mechanized methods. There are separate courses under the Equipment Operative Curriculums which are also relevant to maintenance. The courses focus on the proper work methods in accomplishing repairs. Initial training is given at the Training Centre and consists of introducing the trainee to the specific step by step process for carrying out the maintenance. After this initial training, most of the time will be spent in supervising actual maintenance crews in the field under the guidence of a trainer from the Training Centre. This will be done on a TPU type basis.

107. The third segment involves training of rural roads Labour Foremen and Superintendents in the organization and conduct of labour intensive maintenance on low volume rural roads. This training will follow a similar pattern as the main highways training in segment two. Initial training will be at the Alem Gena Training centre with most of the time spent in actual maintenance work on short sections of selected roadways.

108. The above strategy follows the belief that the most effective maintenance training is accomplished by teaching the basic correct work methods to the lowest level supervisor and having him teach his work crew what he has learned. To ensure his success he must be provided with sufficient training so that he retains what he has learned and is able to convey it to his crew.

(iv) Roughness Progression Prediction Model, G. Lienbard, France

(v) Pavement Strengthening Methodology, P. Baggare, CEBTP, France

(vi) Road Rehabilitation and Maintenance Projects of Swiss Development Co-operation in East Africa and Madagascar: Experiences and Lessons by Mr. Paul Peter, Swiss Sectoral Service on Infrastructure

109. The Swiss Federal Law on International Development Co-operation and Humanitarian Aid of 1976 concentrates the technical co-operation to the assistance to lesser developped countries, regions and groups of the population.

110. It promotes primarily the development of rural areas, the improvement of the living conditions, food, education, health, the creation of employment opportunities and the maintenance of an ecological and demographic equilibrium.

111. One of the governing principles is the full responsibility of the recipient country or population group for its development policy. Swiss assistance is meant as a supplement to efforts, defined and undertaken by the country and its people. As a partner in these development co-operation efforts, Switzerland as a donor is well aware that impacts can only be achieved as a result of joint endeavour.

112. Infrastructure as an essential component of (rural) development has always played an important role among the Swiss development activities. Among the 26 sectors defined by OECD (DAC), transport has shown a very high increase and figures as a single sector now second behind agriculture in terms of financial resources involved for the period 1981-1985, representing about 8 per cent of the engagements.

113. Swiss road infrastructure projects in Africa in 1986 (in the form of bilateral aid technical assistance) amounted to 25 million Swiss Francs (out of a total Swiss development assistance of 190 million Swiss Francs). The projects were located in Tanzania, Kenya, Madagascar and Mali.

114. Swiss assistance in the African region has been complemented by other donors, such as the FRG (GTZ), Norway (NORAD), Netherlands (NUFFIC), and Ireland in Tanzania; NORAD, CIDA, DANIDA and SIDA in Kenya; and World Bank and IDA in Madagascar.

115. Besides the rehabilitation of highways and rural roads, and the support to road maintenance, the emphasis of Swiss assistance is based on training for different professional levels required by the sector; especially for labour intensive maintenance methods. Swiss assistance, however, is generally geared to a situation of "self-reliance" of the beneficiaries, in view of the conviction that the "road" is the backbone of the economic development of any region.

(vii) Maintenance Management in Zimbabwe by Mr. Murimba, Planning, Ministry of Transport

116. In Zimbabwe, recent years have witnessed the increased awareness amongst road engineers of the need to move away from the ad-hoc method of determining road maintenance priorities and needs and adopt some sort of management system. In addition, a continued decrease in road maintenance funding demanded that the available funds be applied with the maximum effect. This awareness led to the implementation of a pilot maintenance follow-up system. This pilot system further led to the development of a more detailed microcomputer-supported Maintenance Management System.

117. The Ministry of Transport, with assistance from the Swedish International Development Authority and Sweroad Consulting is developing a Maintenance Management System using overseas experience in maintenance management and Zimbabwean parameters. It can be argued that because of this arrangement the development implementation phase is taking longer than originally expected as compared to adopting externally developed systems, but it was originally considered that a tailor-made system would have definite advantages over the others.

118. The objectives of the system are primarily to:

(a) set up an inventory of the road network, which is the cornerstone of any management system;

(b) enable the Ministry's maintenance organization to accurately estimate maintenance needs and translate such needs into costs and resources using feed-back from the system;

(c) provide the Ministry with a tool to distribute the maintenance funds to the provinces on objective grounds, e.g. considering road conditions, traffic, road class, climate, etc.

(d) provide the Ministry with an instrument to check the efficiency of its operations by providing facts on costs and production for various maintenance activities plus facts describing the road standard over a period of time;

(e) enable the Ministry to request reports and realistic forecasts in accordance with annually set priorities;

(f) justify estimates of expenditure to Treasury using production reports and the expected road standard.

119. Although there have been some problems, the MMS has been found to be extremely useful for the planning of maintenance work in the provinces. The system also ensures that funds earmarked for road maintenance are not used for other works. The system is expected to become even more useful when decentralized to the Provincial Road Engineer's Office.

(viii) The Maintenance Aspect of Road Planning: Goals of the Secondary and Feeder Road Development Programme, (SFRDP), in Zimbabwe, by A. Buhrman, Sweroad)

120. The maintenance problem may be divided into the following five problem groups: (a) Attitudes towards maintenance, (b) Financial problems, (c) Organizational problems, (d) Managerial problems and (e) Technical problems.

121 Maintenance in developing countries is usually neglected, in favour of construction. This attitude problem in turn affects the amount of finance made available by planning and finance ministers for maintenance purposes.

122. A lot can be said around such common organizational problems in government as lack of incentives, split responsibilities (sub-optimization), lack of accountability, and inflexibility and red tape. Managerial problems include lack of training, lack of information and monitoring systems, and lack of policy and priorities. Finally there are the technical problems. In addition to inadequate training schemes, and inadequate resources and training schemes, and some overstaffing problems, there is a serious equipment and methods problem and the limited knowledge with regard to economico-technical relationships in maintenance affecting proper maintenance planning.

123. Cuts in maintenance expenditures, whether in the State road network or the Secondary and Feeder network, will undoubtedly result in poor riding conditions and hence increased vehicle operating costs, and drastically increase transport costs. Optimum maintenance strategies therefore need to be worked out.

(ix) Maintenance by Contract: The Ghana Experience, by SBK Bonsu, Ghana Highway Authority, (G.H.A)

124. Maintenance by contract has proved successful in the Ghana experience. Without the existence of an effective Maintenance Management System this achievement would not have been possible. "Experience", it is said, "is the best teacher". The economic depression into which Ghana sunk in 1983 aided the evolution of the current maintenance system in Ghana. It is the intention of G.H.A to increase the involvement of contractors in the periodic maintenance activities.

125. The use of the single man contract (S.M.C.) makes it possible for developing countries to execute maintenance works with minimum investments in equipment thereby reducing foreign exchange requirements.

126. The reduction in the number of staff as a result of our maintenance practices paves the way for incentives, within the GHA (Ghana Highway Authority) and for improvement in managerial skills and ability and improvement in the overall maintenance of the road network.

(x) In Situ Pavement Retreading with Arc 600 by Michel Guerin, CETRA-France, presented by M. Morin.

127. The in situ pavement retreading (recycling) process consists in recreating, from a damaged pavement unsuited to usual traffic, a homogeneous and stable structure. Existing materials are therefore retreated (recycled) in situ with a binder and possibly complementary materials in order to obtain a new road base or sub-base.

128. Retreading makes it possible to restore the pavement bearing capacity and profile while limiting the need for "fresh" aggregates and modifying geometrical characteristics as little as possible.

129. It is not a recent technique as it started in France in the 1950's. It was taken up again after the exceptionally cold 1962/1963 winter so as to recondition pavements damaged by frost: at that time specific stabilizers were used. The performances of these machines were however still low.

130. Cement in preference to bitumen is generally used as a binder because:

- it is better suited to clay, which is frequently found in old pavements, and makes it possible to rejuvenate the pavement in all its depth;
- it gives the retreaded material much more rigidity and resistance to rutting.

131. France has now a lot of experience in cement retreading - from fine soils in earthworks to aggregates with continuous grain size distribution - to make road bases (over 20,000 km).

132. After almost falling into disuse, there has now been for a few years a fresh and strong interest in "insitu" pavement retreading. This is due to two major reasons:

- a high increase in the cost of road techniques subsequent to an important rise in the cost of energy (and consequently of transport) and of bitumen made it compulsory to find less expensive alternative pavement strengthening techniques;

the major part of the secondary roads network (345.000km) is not suited to heavy traffic when the thaw is setting in after a severe winter; during the winters of 1985, 1986 and 1987, many roads had therefore to be closed to trucks, which led to a significant reduction in economic activity; but usual traffic (on an average less than 150 heavy trucks each way per day) does not justify important investments; it was therefore necessary to find techniques adjusted to this type of network.

133. In situ pavement retreading offers several advantages in this respect:

- Re-utilizing materials in situ makes it possible to save on aggregates and their transport; it is an important saving as the cost of aggregates doubles beyond 30 km of transport compared to 50 km 15 years ago; furthermore, if aggregates are transported over a distance of 15 km, it is more expensive to add a new road base than to retread the pavement in situ, in so far as this process is technically feasible of course;

- Concurrently, by reducing the consumption of "fresh" aggregates, pavement retreading contributes to better protection of the environment and to less fatigue for the adjacent road network thanks to reduced transport of materials;

- This process makes it possible to use cement, a local product well adjusted to the more or less polluted materials to be reconditioned;

- Retreading improves frost resistance of the pavement through the slab effect; on the other hand, this protection is not as good as strengthening with an additional layer.

- This technique avoids reducing the width of road shoulders resulting from strengthening with an additional layer.

134. Finally, machines are now much more powerful and can retread depths reaching 25-30 cm with good mixing quality.

135. Many French enterprises have therefore purchased a road retreading plant and some have gone as far as designing specific machines, such as the ARC 600 of the BEUGNET company.

(xi) Discussion of Agenda Item 5: OPERATIONS: The various interventions and subsequent deliberations that ensued are summarized as follows:

Congo: The representative emphasised the importance of Training and described the establishment of the training programme in the Congo. Training had been linked to promotion prospects for the participants in order to encourage attendance and the Centre began to develop into a national resource. It was also planned to use it for the private sector but recent financial constraints negated all plans. He thought there should be more exchanges between countries for training courses.

ESAMI: The representative explained the content for the Maintenance Management Course aimed at Engineers, Planners and Economists involved in this field. He also gave details of the establishment of an African Transport Management Studies Centre to be based in Nairobi.

Mali: The representative explained the Training programme and stated the importance of incentives and the necessity to link the training to career development. On labour-intensive operations Mali has problems due to finances but he supported the involvement of the WFP which had been decisive in the completion of one project.

136. He wanted to know from Zimbabwe what problems there had been in setting and running up the MMS.

137. Zimbabwe delegate replied that the amount of work involved had been far more than anticipated because they were developing their own system. Then it appeared very complex to all levels of management and in some areas there was lack of support for introduction of the system.

138. Another Zimbabwe delegate questioned the Ghana delegate about the payment for the maintenance work by contract described in his paper. In reply the Ghana delegate stated that each SMC (single man contractor) had daily tasks identified for which he was paid on completion. His daily wage included all the added benefits. The situation currently existed where payment was made for work done.

139. The Malawi representative explained the involvement of local communities in the District Roads Programme and the Village Access Roads and Bridges project. He emphasised that the initiative came from the District Councils and labour was provided on a self-help basis with technical input from the Ministry. Once roads were rehabilitated they were passed to the Ministry for maintenance purposes.

140. From the presentation of the various papers and the ensuing discussions, the following main trends were highlighted:

(a) Adequate solution of problems relating to the training of the labour force in this sector, implies that efforts should be oriented towards the establishment of national and regional training centres at the various levels required; and encouragement of trained personnel by guaranteeing them prospects of promotion. In this regard the experiments attempted in Congo and perhaps Mali could be entirely adapted to suit other African countries. In any case, this training should cover various levels such as Maintenance Management activities, and method of work for the labour force.

(b) The effective involvement of local communities in road maintenance activities, implies that specific, beneficial work contracts should be signed between these communities and the governmental Authorities concerned, in such a way as to indicate the level and methods of remunerating work completed. In this regard, supplementary assistance (of nearly 148 million US$) for the mobilization of the labour force required for road maintenance and rehabilitation activities, has made its mark on a good number of African countries; and this, in spite of the fact that one delegation expressed its reservations on the effectiveness of such assistance.

The contract should also specify the technical training to be provided for these communities, inorder to increase their capacity to intervene at appropriate levels of maintenance and rehabilitation activities on the road network in their respective regions.

(c) Concerning the use of small scale local contractors, for road maintenance activities, the meeting encourages the extension of such practices, on account of the success achieved in this sector in Ghana, Benin, Malawi, etc. It is necessary, however, to ensure that the services provided are adequately remunerated, so as to guarantee satisfactory productivity through such contracts.

With regard to contracts with the private sector and particularly for major network rehabilitation and maintenance activities, it is recommended that such practices are adapted wherever necessary. This would lead to definite advantages namely, flexibility of such contracts, a less cumbersome bureaucracy, relieving government authorities of the responsibility of directly managing such maintenance activities, the release of funds required for clearly programmed maintenance activity, according to the contracts, the promotion of local enterprises with the required qualifications...etc.

(d) The establishment of an effective organization for management, maintenance and rehabilitation of the national road network should be encouraged. In this regard, attempts should be made to collect reliable data on road traffic, deterioration of the road network, maintenance costs, road accidents, the level of the labour force, the degree of availability of funds, the objectives of road maintenance...etc. On the other hand, attempts should be made to define the desired performance standards. Furthermore, it will be necessary to give a detailed bread down of the different levels of costs involved in the preparation, execution and monitoring of a coherent road network maintenance and rehabilitation programme. Having a full grasp of all these procedures, implies a high level of awareness and effective solution of problems which could arise from its implementation.

141. The moderators, in summing up the main issues raised, said that (a) the importance of training and carrier development, (b) the development of Maintenance Management Systems (c) the involvement of local communities in road maintenance activities were the three main topics that had emerged as vital in the complex maintenance problem in Africa.

WORKSHOP I - ECA Road Maintenance Handbook for Africa: (agenda item 6)

INTRODUCTION (France)

142. Over the years, the African countries have indicated how important they consider the improvement of roads and road transport. One of the vital activities for protecting the considerable investments made in road infrastructure is none other than the effective maintenance of roads and drainage structures. Providing he has adequate materials, tools and facilities, the foreman is the person who is responsible for maintaining the roads. The ECA manual is especially intended for foremen. It was prepared in response to the wish expressed by the African countries at the Second African Conference on Road Maintenance at ACCRA in 1977.

I. DESCRIPTION OF THE MANUAL

143. The road maintenance manual was published in French and English and contains three separate volumes:

VOLUME I - Maintenance or roadsides, drainage structure and signs, divided in four sections:

A - Terminology
B - Drainage, shoulders and Slopes
C - Bridges
D - Traffic Control Devices

VOLUME II - Maintenance of unpaved roads, divided in four sections:

A - Grading
B - Dragging and light grading
C - Filling and patching (spot hand-patching)
D - Regravelling

VOLUME III - Maintenance of paved roads, divided in three sections:

A - General Repairs
B - Surface dressing
C - Overlays

144. Each volume is presented separately in pocket size (11.5 cm x 19 cm). Each section listed above concerns a clearly determined maintenance task and is presented in a comparable manner. However, this foreman or Gang Head "guidebook" has been purposely simplified so that it contains only indications on work implementation. The text is concise and well illustrated.

145. As it is intended for all African countries, the manual could not study in detail the conditions specific to each country : climate, terrain, road system development, traffic and so forth.

146. In order to remain on a general level, each task is broken down as follows:

- A definition of the task which made it possible to standardize the vocabulary to be used and to set out the objectives sought.

- A definition by type of task of each degradation is presented, together with its location, its importance, its causes, its possible evolution and its remedy.

- A list of the necessary resources is furnished : personnel, equipment, materials, tooling and work site signs.

- A description of work execution serves to present chronologically what is to be done as concerns:

  . work preparation (become familiar with the orders received, inspect the section to be treated, assembly the resources),

  . signs for the work site,

  . work execution,

  . finishing and closing the site,

  . report on the work done.

147. By following the instructions step by step, the foreman should be able to carry out correctly the task he is in charge of.

II - RULES FOR THE UTILIZATION OF THE MANUAL BY AFRICAN COUNTRIES

148. As the various volumes are intended as practical handbooks, numerous coloured illustrations are given opposite the text for easier comprehension.

149. This constitutes a concrete aid for learning to use the correct terminology, to become aware of the importance of adequate inspections and to choose the required task in order to remedy a certain degradation. It is then necessary to know which means of execution may be used effectively and which safety measures must be taken. The methods of execution are aids and general recommendations.

150. In order to guarantee efficient use of this road maintenance manual, account should be taken not only of the conditions specific to each country, but also of the indispensable adaptation of the executing foremen to the population and to the hierarchy charged with enforcing the instructions.

151. Indeed, in order to provide timely maintenance in compliance with the rules of the manual, it is necessary that precise instructions be issued by the Road Offices and that all the necessary means be put in place (qualified personnel, adequate equipment, appropriate materials). When using the manual, foremen will be efficient only if their superiors take into account everything that is prescribed to complete the described tasks.

III - THE MANUAL : A REFERENCE AND TRAINING WORK

152. This road maintenance manual is intended for personnel who direct the execution of maintenance works. After adjusting it to the country, the manual must serve them as a "reference". For the Roads Office and its direct services, this reference must be acknowledged officially, thence the necessity for adapting it to the methods practiced in the country and to the existing organization. The complexity of the subject did not allow the authors to say everthing in the texts. For this reason, the enforcement of the instructions and orders of the manual shall be the subject of questions and problems to be solved by higher authority. The manual will thus serve as a basic work for foremen who must nevertheless be trained in its utilization before any implementation of the prescribed instructions is started.

153. In addition, the manual is the trainer's basic book. The organization of training is made easier thanks to the breakdown of each task and the presentation of a logical sequence of the various actions to be undertaken: list of the resources to be assembled (personnel, equipment and materials), chronological work sequence (preparation, works and site closure), type of report to be submitted for follow-up, and so on.

154. The stages of "on-the-job training" are described in this manner, and a simple complementary explanation is all that is needed.

155. Lastly, the three volumes of this road maintenance manual may be used for teaching the main objectives of road maintenance as part of the vocational training of youths.

IV - PROSPECTS FOR THE FUTURE

156. The pedagogical construction of this manual is undeniable. It could be used in the future as follows:

- a model for the preparation by country of a manual adjusted to the staff and the national context,

- a basis for a "trainer's guidebook", including a training plan, lecture cards, field exercises and training evaluation cards,

- a guidebook for supervisors in charge of road maintenance, who must program, order and control completed works.

157. Finally, its translation into other languages than English and French could make the manual more usable in African countries where Spanish, Portuguese and Arabic are spoken.

158. This "Road Maintenance Manual" is very typical of the accomplishment of a deepseated wish on the scale of the African Continent, which deserves to serve an an example in other fields and for other continents.

159. The Moderator, opening the WORKSHOP, went on to review the dissemination of the Handbooks undertaken by the Transport and Road Research Laboratory, UK,and others; and revealed that the original stock of copies held by the Laboratory were almost exhausted. Surprisingly, requests for the Handbooks had been received not only from countries in Africa but also from Europe, Central and South America, the South Pacific, Middle East and South-East Asia. It was reported that Brazil had translated the Handbook into Portuguese.

160. He concluded his opening remarks by asking delegates to consider whether ECA should reprint the document and if any major revisions were required. Given the apparent demand outside Africa, he thought that it could no longer be considered a purely African publication and could usefully be translated into Spanish.

161. The Chairman then invited Mr. M.P. Douglas to report his experience of using the Handbook in Zimbabwe.

162. Mr. Douglas explained that the Handbook had definitely proved useful in Zimbabwe although some resistance to the introduction of the techniques in the Handbook had been felt where these conflicted with current practice. It had proved particularly useful as an aid to training of maintenance personnel. Although Zimbabwe had comprehensive manuals produced by the Ministry of Transport, the Handbook was a useful supplement and he felt that it would be even more useful in countries that had not yet produced their own publications. He concluded by describing some minor errors and omissions he had found in the Handbook.

163. The ensuing discussion revealed that there was general agreement on the usefulness of the Handbook. The Chairman remarked that the combination of text and illustration was particularly appropriate and revealed that in Zaire, relevant parts of the text were photocopied and card mounted for use in the field.

164. One delegate confirmed that demand for the French language version had also been high and that in Morocco, the Handbook had been adapted to produce their own version.

165. The delegate from Senegal enthusiastically supported the Handbook and requested further copies. Two delegates suggested improvements in the format. The Swiss delegate suggested that future editions be produced in a ring binder to make it easier to pull-out relevant parts of the text for use in the field and to insert local revisions. M. Morin suggested that eventually the text should be available as a diskette and the illustrations as transparencies should allow easy modification to suit local conditions using a word processor.

166. The ECA representative, Mr. Shifarraw Bizuneh, explained that copies were available from Addis Ababa and appealed for more feedback from users. He also revealed that Carl Duisberg were considering producing an additional manual specifically designed for training of trainers purposes and that it may be published soon.

Workshop II - Road Research and Applications to Maintenance (agenda item 7)

167. Introductory papers intended to stimulate discussions in workshop 2, were presented one after the other, on the following topics:

- Pavement Management Systems;
- Maintenance of Unpaved Roads;
- Pavement Monitoring;
- Technology Transfer Mechanisms.

(i) Pavement Management System

168. The representative of the OECD's Road Transport Research Programme addressed the need for a systematic approach to pavement maintenance management. Referring to a recently published international OECD study on Pavement Management Systems (PMS), he highlighted the needs, purpose, users benefits and fields of application including road network and project levels. He developed the basic building blocks of PMS emphasizing the efforts needed for data organization and underlined the long-term development of an adequate data base. Pavement condition rating is essential in order to be able to operate optimization procedures as is the case for appropriate cost information, including vehicle operating (road user) costs which are a multiple of maintenance and/or pavement costs. Radical guidelines for establishing a PMS and for ensuring success in implementing a PMS are put forward in the OECD report. PMS can provide a useful long term planning, programming and management tool, ensure the choice of cost-effective maintenance strategies with budget constraints and contribute to securing adequate funding levels through both national and external sources - as well as accountability and control. In closing his statement the OECD representative urged the African nations to prepare the groundwork for introducing such maintenance management systems that are tailored to local needs.

(ii) Report on Maintenance of Unpaved Roads

169. The report relates to the experience of some countries and organizations with regard to maintenance of unpaved roads. From this analysis it can be seen that:

- the need for maintenance must be considered from the planning stages of the road project, especially in the light of operating costs of the road;

- decision-making requires being familiar with the parametres of quality and quantity, either based on an inventory of deterioration levels, or on visual inspection. The types of deterioration characteristic of unpaved roads, and the tolerable thresholds of deterioration are described in the report.

170. The determination of priorities in relation to these deteriorations and budgetary and institutional constraints is also envisaged.

171. The report also describes the most adaptable and least costly maintenance techniques, taking into account the country's socio-economic conditions.

172. The various maintenance techniques; grading, scraping, gravelling, are described with a view to assisting the "decision maker" in his task.

173. The various studies undertaken on this subject are summarized in the last chapter of the report.

(iii) Pavement monitoring handbook

174. The most important aspect of the issue pertaining to pavement monitoring was dealt with and emphasis was put on: efforts undertaken since 1986 within the OECD, aimed at developing a simple and operational system of monitoring of surfaced and unsurfaced roads. The draft manual intended for the use of engineers, planners, and advisory bodies involved in road network maintenance and rehabilitation activities, will be complementary to the ECA manual on road maintenance.

175. The system of pavement monitoring (auscultation) can be applied to both surfaced and unsurfaced roads. A catalogue of deterioration levels is included in the manual.

176. The system of auscultation (monitoring) is not a pavement maintenance system, but it could be considered as the first phase towards such a system. It is a flexible system which can be adjusted to adapt to various structures.

177. The manual is based on visual checks, with only a few additional statistics and depending on data accumulated over a certain period, it will also supply information on future maintenance activity required.

(iv) Technology transfer mechanisms

178. The OECD representative explained the purpose, operation and structure of the International Road Research Documentation scheme to which 35 institutes of 20 countries contribute on a regular basis. It is a world wide accessible data base containing currently 175,000 records on road related publicatons and research in progress. Active involvement of African nations in terms of study data input and usage of the information base is highly desirable and could ensure substantial benefits to the professional communities concerned. The IRRD scheme is of interest to policy analysis, road authorities, managers, practising engineers and educators. In order to enhance the current effectiveness of often fragmentary technology diffusion initiatives, measures should be taken to establish an operational scientific and technical network for the exchange of recent study results in Africa, relating to maintenance management experience, guidelines, technical recommendations and standards. The international organisations active in the road sector such as the UN Regional and Subregional Organizations, the World Bank, PIARC, IRF and OECD/IRRD should join together in co-operation with the highway organisations in the African nations to identify national and/or regional focal points for information exchange in the most appropriate form.

Discussion of Agenda Item 7 (Maintenance Research)

179. The debate focused on the four topics of agenda item 7 dealt with in the individual OECD presentations

- pavement management systems and their current aplicability in Africa;
- the importance of the maintenance of unpaved roads and serious technical economic and organizational aspects;
- the development of the OECD pavement monitoring and condition rating handbook planned to be issued in 1988;
- the need for mutual exchange of information for improving technology transfer, as well as the service offered by OECD's International Road Research Documentation Scheme.

180. There was agreement that before embarking on sophisticated pavement management replicas, emphasis should be laid on condition rating backed up in an appropriate phase, mainly by visual inspection results. Data acquisition and the development and continuous updating of a data base are of crucial importance; also cost information - paramount costs; maintenance costs and road user costs - was especially warranted. While there was a need for simple, rapid and dynamic management systems tailored to the local needs, PMS such as used in the U.S., Canada and Europe should be considered as a long-term target. At present, simplified approaches such as the model used in Morocco could be employed usefully for the purpose of managing maintenance budgets; the systems used should

respond to the information requirements of the type of user concerned, - decision-makers, management, technical levels - and the specific conditions of the countries and/or regions concerned. The content, structure, operations and applications of the World Bank's HDM model was highlighted. In Malawi, it was used as a tool for deciding on maintenance options and in other countries it was successfully applied at the network level.

181. The evaluation of the condition of unpaved roads, by means of visual inspection, can already measure up to the requirements of data to be included in the World Bank's HDM model. However, it would be advisable to carry out monitoring through rational methods based on measuring equipments, in order to support the technical and economic analysis of maintenance strategies. Maintenance of unpaved roads should be envisaged right from the planning stages of the road project. Recurrent costs should be immediately integrated in construction costs.

182. Enough emphasis cannot be placed on the importance of ensuring maintenance and protection of the roadside areas. Unpaved roads need to have continuous maintenance from the time they are constructed. Maintenance and its organization depend on the type of deterioration and the degree of mechanization, which must be correctly balanced in relation to employment (social aspect). With regard to mechanization, information on tools manufactured in Africa should be compiled, highlighting for example, the use in Zimbabwe of tractor towed graders, which were manufactured locally.

183. Apart from maintenance activity, the protection of unpaved roads should develop and rain barriers should be reinstated in some cases.

184. The planned OECD handbook on pavement assessment and rating was very well received. It should be simple, attractive and easy to use. Comments from African maintenance engineers and pilot testing in some African states would be useful before issuing a final guide. The assistance of the World Bank in disseminating this guide would be desirable. Various speakers agreed with its focus on visual inspection linked to a damage catalogue with indices on the magnitude and extent of pavement deficiencies. Some discussion centred on the use of PC's to analyze the inspection data, but it would be up to the end user whether PC aided analysis procedures would be adopted or not.

185. Following the report on the International Road Research Documentation Scheme of the OECD, backed up by a video presentation, the need for a better exchange of information and experience between African States was highlighted. There was concern that the technology gap between North and South was widening. The OECD representative stressed that the IRRD was open to all countries and that OECD countries and IRRD centres would be willing to assist interested African States in joining this international co-operative scheme. If the information input from developing nations could be enhanced, the benefits to all professional circles would be great. The ECA may perhaps consider how this could best be done by acting as an information broker for the region.

186. In closing the Workshop, the Third Vice Chairman Mr. Ekouolo (Congo) highlighted once more the precarious financial situation of the African States making it difficult to adopt and finance advanced technologies. The development pace chosen should not be too rapid and locally adopted and appropriate techniques and management procedures needed to be employed and further enhanced.

Road Deterioration in Africa and follow-up under the SSATP road maintenance initiative (agenda item 8)

187. The moderator Mr. J. Doyen from the World Bank gave a general introduction on Sub-Saharan Africa Transport Programme which is currently under development. He outlined the crucial role played by African intergovernmental organizations like the Union of African Railway (UAR), PTA, ECOWAS, ESAMI etc. He informed the meeting that SSATP has a management Committee and an International Advisory Committee which is Chaired by the ECA Executive Secretary and that there are two African ministers of transport among its members.

188. Details of the SSATP programme, especially the forthcoming highway maintenance workshop series were presented by Mr. Wolden also from the World Bank.

189. He informed the meeting that SSATP had four components, namely: surveys of the state of transport, workshops, research, and institutional/manpower development.

190. With regard to overall structure of the road maintenance initiative/workshop, he said that the programme had three phases. Phase one is concerned with three awareness workshops, the second phase is devoted to action plans to be developed from the workshops, and the third phase is mainly monitoring and assessment of action plans. He said that the implementation of the three phases would last five years, and would be carried out in collaboration with ADB, ESAMI, ECOWAS and ILO. Background paper for the Workshop would be prepared by the World Bank, UK, Norway, and the Federal Republic of Germany. The three countries are also to finance the Workshops.

191. A delegate from Zimbabwe presented a paper on Road Deterioration in Zimbabwe and informed the meeting that the project was initiated in 1984 to monitor deterioration parametres of the paved road network. He said that the parameteres used were: traffic loading, deflection measures, rut depth, surface cracking and surface roughness.

192. He informed the meeting that some problems have been encountered during the execution of the project. He said that the main problems were frequent breakdowns of test vehicles and the unavailability of spares for those vehicles.

193. He concluded by informing the meeting that results to date indicated that there was no critical failure of the test sections.

194. Mr. P. Fossberg introduced his presentation by saying that the estimated road restoration backlog in Africa amounts to some US$5 billion. He added that roads presently in critical condition, will during the next decade deteriorate into the "poor" category, calling for another US$5 billion to be spent during the next decade to restore them. He estimated that that represented a medium of 3.3 per cent of GNP, but with variations between countries from 0 to some 37 per cent, the latter obviously represented needs in excess of available resources.

195. He informed the meeting that classifying countries in terms of decreasing GNP, and in terms of declining capacity to finance required restoration, one found a preponderance of African countries in the most disadvantaged position, signalling the particular seriousness of the problem in Africa. This he said meant that while some countries could get by with small to medium (up to 50 per cent) increase in their road budgets and a transfer of resources from construction to maintenance, a large proportion of African countries would continue to depend on further assistance to attain their restoration goals. He concluded that those countries represented the hard core of the problem.

196. He said further that marshalling of resources to meet those needs might, in addition to reallocation of funds from construction to maintenance, also involve increased road use taxation, as well as earmarking of funds, to ensure that a sufficient part of the revenues were reverting to the road sector. He finally said that for most countries, it would need external financing from multi- and bi-lateral sources, conditional on agreed strategies and priorities, and involving reforms and improvements as required.

197. In conclusion he said that such institutional issues and actions involved the following:

(a) more use of management tools to help decision-makers in making optimal resource allocations;

(b) stronger sense of accountability for money spent and targets and objectives achieved;

(c) larger public awareness of the importance of maintaining good roads;

(d) more reliable funding through the budgets and timely release of money;

(e) strengthening of technical assistance and technology transfer;

(f) strengthening of human resources management, through accountability and incentives;

(g) more attention to mobilization of local resources, to help in project sustainability; and

(h) more attention to private involvement in road maintenance, including the development of local contractors.

198. Following the three presentations the meeting discussed the issues raised and eventually resolved that:

(a) Efforts should be made to invite officials from the ministries of finance and financial institutions to participate in the SSATP maintenance workshop.

(b) The period of five years proposed for the implementation of SSATP is too long and should be reduced. The African consultants should be approached to contribute in the implementation of SSATP.

(c) More efforts should be made to increase public awareness on road deterioration. The use of public media should be given consideration where possible.

(d) Countries which do not have national road association but would like to have them should consult with IRF on the types of assistance IRF can make available to them in the formation of national road associations.

(e) It is important for African countries to carry out adaptive research regarding road deterioration and research such as Zimbabwe and other countries have carried out.

(f) The World Bank should prepare a short paper on road deterioration in Africa, for presentation at the Conference of African Ministers of Transport, Communications and Planning which will be held in Kinshasa, Zaire in the first quarter of 1988. The report of this meeting including its findings and recommendations should also be presented at the Kinshasa Conference.

Other matters (agenda item 9)

199. No matters were raised under this agenda item.

Conclusions and Recommendations (agenda item 10)

200. In conclusion, participants felt that the major theme emerging from the Conference is the need to address the road deterioration problem through increased political attention, institutional reform and mobilization of resources.

201. Previous Conferences and Seminars have created a broad consensus on the importance of road maintenance and on the direction and content of programmes to strengthen maintenance capacity and to make better use of resource devoted to roads. Programmes undertaken have, on the whole, been insufficient to reverse the trend toward deterioration. The capacity of African countries to cope with the mounting maintenance and rehabilitation requirements has been undermined by the economic crisis and by the deterioration of public finance.

202. Priority will have to be given to the protection of existing networks through maintenance, rehabilitation and strengthening. If these requirements are not addressed, countries will have to bear the much higher economic costs of:

(i) more expensive and unreliable transport services and foregone economic activities and,

(ii) costlier reconstruction at a later date.

203. Recent research and technical advances in road network analysis offer the basis to evaluate maintenance strategies corresponding to various levels of resources. The implications of this analysis should be brought to the attention of decision-makers and users to increase their awareness and generate broad-based support and pressure for improvements in all aspects of road maintenance and rehabilitation.

204. The Conference has shown the value of the experience gained by several countries engaged in programmes to step-up their road maintenance and rehabilitation capability. This concerns the critical aspects of strategic planning, maintenance management systems, manpower development, use of contractors etc. It would be important to promote opportunities for cross-fertilization and exchanges among African highway planners and managers, as successful approaches tested in real-life contexts emerge. It would be equally important to ensure their diffusion.

Recommendations

205. The fourth African Highway Conference meeting in Harare Zimbabwe from December 7 to 11 made the following recommendations addressed mainly to African Governments, in particular to departments and agencies thereof responsible for financing, planning and upkeep of public roads. These recommendations are also addressed to African regional and subregional organizations as well as specialized UN agencies. Finally these recommendations are addressed to bilateral and multilateral development agencies and institutions that are providing support to road infrastructure in Africa. The recommendations are meant to capture the broad areas of consensus which emerged from the work of the Conference. They also mention specific requests for follow-up actions.

(1) African Governments should more than ever concern themselves with maintenance and rehabilitation of existing road networks. For this purpose they should:

(i) introduce administrative and institutional reforms to enable them to formulate and implement more effective road maintenance and rehabilitation policies;

(ii) develop and implement well adapted management systems for roads, bridges and equipment so as to maximize efficiency in use of scarce resources.

(2) Maintenance and rehabilitation of existing roads should be given preference over new construction so as to protect existing investments - in some cases optimum use of scarce resources would lead to concentrate maintenance and rehabilitation programmes on the priority network.

(3) Institutional reforms and personnel management policies should result in strengthening of accountability at all levels, for the use of resources and for attaining set works and institutional objectives.

(4) Road users, communities and the population at large should be made aware of the importance of a good road network for economic and social development and well-being, as well as for road safety and costs of transport services, so as to encourage and accept the allocation of adequate resources to the road sector. Governments should seek to interact with responsible representatives of road users, transport operators and economic agents to engage them in the formulation and evaluation of road policies and programmes.

(5) Budgetary mechanisms, e.g. earmarking funds or creating road funds, should be sought which would ensure that a sufficient part of road user revenues is utilized for road purposes. Road user taxation has to be at least adequate to meet these needs, and should be equitably distributed among the road users.

(6) Training and staff development at all levels should be stepped-up to support programmes to improve institutional performance and work methods and to maintain and upgrade basic skills. Training programmes should be augmented by the use of suitable training aids and methods and by staff incentives.

(7) Development agencies and financing institutions should step-up their support for road programmes directed at reversing the trend toward deterioration of existing networks.

(8) Increased reliance on local resources should be encouraged in particular through the application of labour intensive work methods, through the use of local materials and locally based technologies. This should be supported by local and regional organizations and institutions.

(9) Technology transfer and development need consistent support and encouragement, so maximum use should be made of the technology transfer facilities currently existing, and further channels and means of dissemination should be sought.

(10) Axle loading should be controlled to stay within legal limits, so as to avoid accelerated damage caused by excessive loading. Road pavements should be designed to the loads they are realistically expected to carry, and axle load weighing practices should be supplemented by import controls and taxation systems that favour truck dimensions and axle configurations that minimize pavement damage with due regard for traffic safety. The harmonization of vehicle weights and size regulations should be pursued in the framework of programme to promote regional trade and to facilitate transit.

(11) The World Bank in close co-operation with ECA, should consider sponsoring subregional seminars/workshops to sensitize governments on the need to address the road maintenance and rehabilitation problem. Ministries of Finance should be involved in these fora.

(12) (a) The ECA Maintenance Handbook has proved useful throughout Africa and most other parts of the developing world.

(b) ECA Should continue to make copies available and consider publication of a second edition.

(c) Users should be encouraged to report any errors and omissions found in the Handbook to the ECA.

(d) ECA should review alternative publication formats for future edition of the Handbook.

(e) ECA should pursue the development of a trainer's manual linked with the Handbook.

(13) OECD in collaboration with ECA should seek ways to ensure the diffusion and possible adaptation of its forthcoming handbook on pavement condition evaluation for use in Africa.

(14) The World Bank should be requested by the ECA to prepare a paper on the road deterioration problem for African countries. This paper together with the recommendations of the Conference should be presented to the upcoming Conference of Ministers of Transport (Public Works), Communications and Planning.

(15) The ECA should explore the possibility of establishing an "African Highway Development Association" as a forum regrouping African organizations and professionals engaged in all aspects of road development and maintenance. This would specifically consider redirecting the mandate and statutes of the Trans-African Highway Bureau. Alternatively, the ECA should accelerate the establishment of an African Highway Association as agreed during the First Combined Meeting of Trans-African Highway Authorities held 6-10 October 1986 in Addis Ababa, Ethiopia.

(16) Universities and training institutions should give more attention to road maintenance planning and execution, the use of appropriate technologies, and other matters of special significance to the African countries.

Date and place of the fifth African Highway Maintenance Conference (agenda item 11)

206. The meeting discussed the matter at length and resolved that the fifth Conference should be held within four to five years. It was also agreed that ECA should arrange for the evaluation of the previous Conferences in consultation with member States and key organizations.

Adoption of the Report (agenda item 12)

207. The fourth African Highway Maintenance Conference adopted its report as amended during the closing session.

Closure of the Conference (agenda item 13)

(i) Statement of the Representative of the Executive Secretary

208. The representative of the United Nations Under Secretary-General and Executive Secretary of the ECA, in his closing statement, thanked, on behalf of Prof. Adebayo Adedeji and on his own behalf, the participating delegates of African and other UN Member countries and international and African agencies, and especially members of the international community that have provided support to the Conference, his appreciation and profound gratitude for their efforts and a job well done. He said that the Conference had established yet another milestone in that from the points of view of coverage, the excellent quality of the papers presented, and the lively discussion that had ensued, (particularly by African participants,) it has been a resounding success.

209. He singled out the World Bank, TRRL, OECD, IRF, PIARC, ILO; and Sweden and the numerous European countries for sending knowledgable people and high calibre professionals to enrich the Conference.

210. Finally he paid tribute to Zimbabwean officials and highway professionals for their untiring contribution and efforts that ensured the success of the meeting.

(ii) Statement of the Host Government

211. The representative of the Acting Minister of Transport, speaking on the latter's behalf, first expressed satisfaction at the successful conclusion of the Fourth African Highway Maintenance Conference. Furthermore, he underscored the appropriateness of the conclusions and recommendations which resulted from the meeting. He put particular emphasis on the following recommendations:

(i) the need for all projects on road maintenance and rehabilitation to be given priority over projects relating to the construction of new roads;

(ii) the need to set up a consolidated fund for road maintenance. Such a fund could be sustained by taxes paid by road users;

(iii) the need for African countries to have effective management of road maintenance programmes;

(iv) the need to strengthen the monitoring of overloading of vehicles and to impose appropriate penalities;

(v) the need to define and implement suitable training programmes for road maintenance personnel in Africa ... etc.

112. He then declared the Fourth African Highway Maintenance Conference closed.

LIST OF DOCUMENTS

1. GENERAL DOCUMENTS SUBMITTED BY:

   (i) World Bank

   (ii) PIARC

   (iii) IRF

   (iv) OECD

   (v) ILO

   (vi) Egypt

   (vii) Ethiopia

2. ROAD MAINTENANCE ISSUES IN GENERAL

   (i) Road Maintenance Challenge in Africa: Key note Address by ECA.

   (ii) UN Workshop on Road Maintenance in Developing Countries (Sweden).

   (iii) Status of Road Maintenance in Zimabbwe.

3. FINANCIAL ISSUES

   (i) Road Deterioration in Africa: Financial Requirements and Cost Effective Technical Options (P. Fossberg World Bank).

   (ii) Perspective on Road Maintenance and Deterioration (David Brooks, UK. TRRL).

   (iii) Simplified Road Maintenance Systems Financial Approach (M. Morin, France).

4. INSTITUTIONAL ISSUES

   (i) The Organization and Management of Resources. (Mr. J. Doyen, World Bank).

   (ii) IRF Videotapes to improve Road Maintenance Training (T.S. Dong, IRF).

   (iii) Audio Visual Methodology in Road Maintenance Training: Experience in Malawi (Malawi Chief Highway Maintenance Engineer).

   (iv) Maintenance Technology - Low Volume Roads (Bjorn Terstad - S.N.R.A.).

5. OPERATIONAL ISSUES

(i) ILO Experience in Road Maintenance (J. De Veen, ILO).

(ii) WFP's Labour Intensive Food-for-Work Programme (P.L. Simkin, World Food Programme).

(iii) Training Methods for Road Maintenance Personnel, Experience in Ethiopia (S. Griffith, IRF).

(iv) Road Rehabilitation and Maintenance Projects of Swiss Development Co-operation in East Africa and Madagascar: Experiences and Lessons (P. Peter, Switzerland);

(v) Maintenance Management in Zimbabwe (S.T. Murimba);

(vi) Maintenance Aspect of Road Planning for SFRDP (A.Buhrman);

(vii) Maintenance by Contract: The Ghana Experience (S.B.K. Bonsu, Ghana Highway Authority);

(viii) In Situ Pavement Retreading Equipment useful in Dev. countries (M. Guerin, France).

6. WORKSHOP I: The ECA Road Maintenance Handbook

(i) Introduction (BCEOM. CEBTP. LCPC/France)

(ii) Presentation (D. Brooks, TRRL/UK)

(iii) Experiences with the Handbook (M.P. Douglas, Hway Maint. Zimbabwe).

7. WORKSHOP II: Road Research and Applications to Maintenance (B. Horn, OECD)

(i) Pavement Management System (Denmark)

(ii) Maintenance of Unpaved Roads (M. Gorski, Belgium)

(iii) Pavement Monitoring (G. Rafsdal, Norway)

(iv) Technology Transfer Mechanisms, (B. Horn, OECD, Paris)

8. Panel Discussion: Road Deterioration in Africa

(i) Mr. Walden, World Bank: Road Deterioration and the Follow-up Initiative

(ii) Mr. Chikwira, Zimbabwe

(iii) Mr. Fossberg, World Bank

9. Conclusions and Recommendations

10. Closure of the Conference

(i) Closing Statement, ECA

(ii) Closing Address, Host Government

11. Others: ("READ BY TITLE" Papers)

(i) A New Model for Predicing Roughness Progression of Bitumen-Surfaced Roads in Tropical Africa, G. Liautaud, Engineer-in-Chief, France.

(ii) Pavement Strengthening in Tropical Countries: Methodology for Overlay Design of Flexible Pavements, E. Baggare, Engineer-in-Chief, CEBTP, France.

(iii) The Potential of Micro Computers in Managing Road Maintenance, Robert F. Fergestrom, De Leau Cather International, USA.

(iv) A Perspective of Road Deterioration in Africa, R. Robinson, TRRL. UK.

(v) A System to Assist in Highway Management: Decriroute: LCPC, France.

(vi) Follow-up of Highway Maintenance Activities: Sacre, SETRA, France.

(vii) The Maintenance of Construction Equipment in Developing Countries, Bernard Herve, BCEOM, France.

(viii) An Innovation Example of Road Maintenance: The Tahoua-Arlit Road in Niger, Hack Bartton, BCEOM, France.

(ix) The Senegalese Experience in Organizing Resource Management and Maintenance Services (Road and Equipment Maintenance Department, Republic of Senegal).